

# Rapid Hydrogen and Methane Sensors for Wireless Leak Detection, Phase I

Completed Technology Project (2010 - 2010)



## Project Introduction

Under NASA STTR NNK07EA39C, ASR&D developed passive surface acoustic wave (SAW) based hydrogen sensors that utilize Pd nanocluster films on self-assembled siloxane monolayers to provide rapid, reversible room temperature responses to hydrogen exposure. Under NASA SBIR NNX09CE49P ASR&D demonstrated wireless interrogation of SAW RFID sensor-tags. In this project, we propose to combine the results of these two technology development programs to produce wireless, uniquely identifiable SAW-based hydrogen sensors, and to evaluate the sensor response time to low levels of hydrogen exposure (down to 1 ppm). ASR&D will also implement a SAW-based in-situ Pd deposition monitor for enhanced film reproducibility. ASR&D's previous hydrogen work was based on Argonne National Labs work with similar films that demonstrated hydrogen sensing from 25 ppm to over 2% hydrogen, with response times of milliseconds, complete reversibility, and no baseline drift at room temperature. ASR&D demonstrated the ability to measure changes in such films using a SAW sensor, however our ability to test at low hydrogen concentrations and at rates exceeding 1 sample/sec were limited by our experimental test equipment. In the proposed effort, we will utilize an Environics gas dilution system to generate calibrated gas concentrations (for hydrogen and methane) down to 1 ppm, and we will utilize the electronic interrogation system being developed for our RFID work to measure the sensors. This system is capable of measuring sensor responses with a good S/N in 1 msec (or less), overcoming the prior limitations of our testbench equipment. In addition to the hydrogen sensor work, working with Temple University, we propose to evaluate the technical feasibility of producing SAW-based methane sensors using a similar SAW sensor device, but incorporating methane selective supramolecular cryptophane films. Hydrogen sensors will be TRL4 at completion of the proposed effort, and methane sensors will be TRL 3.



Rapid Hydrogen and Methane  
Sensors for Wireless Leak  
Detection, Phase I

## Table of Contents

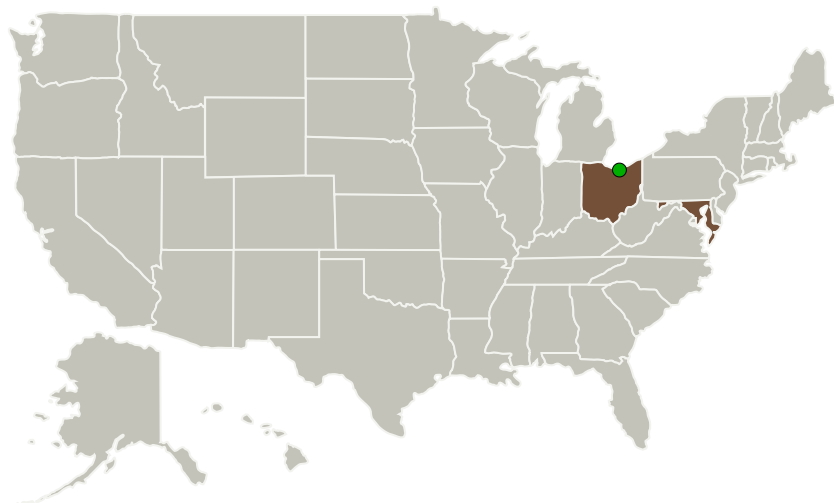
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

Rapid Hydrogen and Methane Sensors for Wireless Leak Detection,  
Phase I

Completed Technology Project (2010 - 2010)



## Primary U.S. Work Locations and Key Partners

Organizational  
Responsibility**Responsible Mission  
Directorate:**Space Technology Mission  
Directorate (STMD)**Lead Organization:**SenSanna Incorporated  
(formerly Applied Sensor  
Research & Development)**Responsible Program:**Small Business Innovation  
Research/Small Business Tech  
Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Jacqueline H Hines

Organizations Performing Work	Role	Type	Location
SenSanna Incorporated (formerly Applied Sensor Research & Development)	Lead Organization	Industry Women-Owned Small Business (WOSB), Veteran-Owned Small Business (VOSB)	Arnold, Maryland
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

## Primary U.S. Work Locations

Maryland

Ohio

## Project Transitions

**January 2010:** Project Start

# Rapid Hydrogen and Methane Sensors for Wireless Leak Detection, Phase I

Completed Technology Project (2010 - 2010)



**July 2010:** Closed out

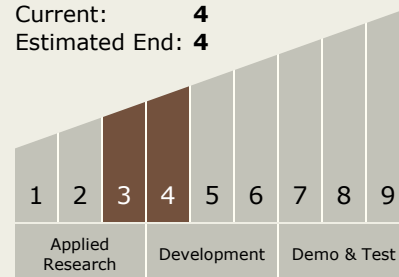
**Closeout Summary:** Rapid Hydrogen and Methane Sensors for Wireless Leak Detection, Phase I Project Image

**Closeout Documentation:**

- Final Summary Chart Image(<https://techport.nasa.gov/file/139379>)

## Technology Maturity (TRL)

Start: **3**  
Current: **4**  
Estimated End: **4**



## Technology Areas

**Primary:**

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System